

## SIR JOHN BENNET LAWES, BART., F.R.S.

ONE of our truly great men has passed away. Born in 1814, his life extended over the greater part of a century full of great men and great deeds; yet among this goodly company he will surely be placed in the front rank if we have regard to his personal qualities, and to the far-reaching and beneficial character of his achievements. An only son, he was left at the age of eight without a father, and owed much of his bringing up to the care of his mother, to whom he was extremely attached. Educated at Eton and Oxford, he entered in 1834, at the age of twenty, on the management of the paternal estate at Rothamsted, Herts. How many youths placed thus early in the possession of a beautiful home, and a sufficient income, would have fallen into habits of easy enjoyment, and left nothing behind them worth recording? But these circumstances, so full of danger to the average lad, were exactly suited for the development of the work which the youthful squire was to accomplish. His active mind obtained at once perfect freedom of action. His love of work and high sense of duty led him to devote himself to the management of the home farm, and under his keen observation its fields became to him pages of nature, which year by year told him new facts, answered new questions, and revealed fresh wonders.

In boyhood Sir John Lawes had somehow imbibed a taste for chemistry. He has told in his own graphic way how he delighted to write with a stick of phosphorus on the door of a dark room, and to give electric shocks to the old housekeeper. On taking up his residence at Rothamsted he proceeded to fit up one of the bedrooms as a laboratory and commenced a variety of experiments. Chemistry was at that time to a large extent a department of medical science, and some of his earliest work was directed to the isolation of the alkaloids of medicinal plants. The manufacture of calomel by a new process—the combustion of mercury in chlorine gas—also engaged his attention; an old barn was converted into a laboratory, and the process carried out for some time on a commercial scale. We have here his first decided step as a chemical manufacturer.

Three or four years elapsed before any experiments were made on agricultural subjects. In 1837 Sir John Lawes commenced growing plants in pots with various substances applied as manure, and more numerous experiments of this kind were carried out in the two following years. His attention had been drawn to the uselessness of bones when applied as a manure to turnips on heavy soils, although they proved extremely effective on light soils. He tried treating fresh bone and burnt bone with sulphuric acid, and speedily remarked the great increase in the manurial effect of the bone so treated. Mineral phosphates, as apatite, were treated with sulphuric acid, and were also found to yield a most effective manure. The value of these acidified manures having been confirmed by trials in the field, both at Rothamsted and elsewhere, it became evident that a fact of the greatest importance to agriculture had been discovered. The farmer was no longer dependent on bone or guano for a supply of phosphate, the vast deposits of phosphatic rocks and minerals were equally available for his use, and could be converted into a potent manure by treatment with sulphuric acid; moreover, the new manure was as effective upon heavy as upon light land.

In 1842 Sir John Lawes took out his patent for treating apatite and other phosphatic minerals with sulphuric acid, thus producing superphosphates. This event laid the foundation of the vast manufacture of artificial manures which now supplies the varied wants of the farmer, and enables him to restore or increase the fertility of his land in the most effective and economical

manner. At the present time the annual production of superphosphates in the United Kingdom reaches the enormous total of 900,000 tons! In other countries the quantities manufactured are equally prodigious. The influence of these manures on the productiveness of the soil in civilised countries is incalculable.

It was a serious step for a young country squire to start a large manure factory, and to enter himself as a wrestler in the keen competitions of commercial life. The difficulties which beset a successful, rapidly growing business are especially great, as the continually increasing demand for capital more than swallows up the accruing profits. But the owner of Rothamsted had already developed his mental powers. His cool head, his quick grasp of a situation, his methodical habits, his enterprising spirit, and his scientific training made him a most successful man of business. In 1843 a manure factory was started by Sir John Lawes at Deptford Creek. In 1857 the business had so increased that 100 acres of land were purchased at Barking Creek, and a much larger and more complete plant erected. The whole of the manure business was sold in 1872 for 300,000*l.*

Having entered upon London commercial life, Sir John Lawes did not confine his enterprise to the production of manures; his activity was displayed in many directions. In 1867 a large factory at Millwall for the production of tartaric and citric acid was acquired. Here the same tale has to be told as that relating to the manure business. The scientific enterprise of the new owner, his carefulness for economy of production, and the advantages he obtained from command of capital, soon placed him also at the head of this branch of English chemical manufacture.

We need not in this place refer at greater length to Sir John Lawes' commercial career, which continued with activity up to his death; it has been due to the man to depict the results of this large portion of his life's work, and also to note the remarkable character which he obtained in the commercial world. His enterprise and command of capital made him at all times a formidable competitor; but his name was still better known as associated with scrupulous fairness of dealing, and in cases of difficulty it became recognised that it was better to trust to Sir John Lawes' generosity than to fight for individual rights.

One might readily suppose that the commercial life of such a successful man of business would have engrossed nearly the whole of his time and energy; this was far from being the case. The wonder of the man was that he carried on so long and so successfully a dual life. He seemed to have the power of putting aside at once all one class of thoughts and interests, and of embarking with perfect freshness and enthusiasm on another subject; and of all subjects, agriculture, chiefly regarded as presenting a series of problems in agricultural chemistry, was the one in which his greatest interests were centred. Business might occupy his mind, but agriculture was always the mistress of his heart. This would appear in a striking manner in the midst of his London work. On the occasion of his weekly visit to the chemical laboratory at Millwall, a very few minutes would generally suffice for the despatch of immediate business, and Sir John Lawes would then frequently spend an hour in eloquent talk with the writer of the present notice upon the agricultural problems which then most interested him. Visitors to the Rothamsted experiments might well be ignorant of the existence of the vast London business. The spirit of the counting-house never invaded Rothamsted; here the experimental fields, and the reports preparing on the results they yielded, seemed to engage his whole attention. No one knew the fields as well as he did, and an afternoon spent at home generally included a walk, spud in hand, through the whole of them.

For the sake of clearness in our narration, we have brought together in one view the principal facts relating to Sir John Lawes' career as a chemical manufacturer; we have next to regard him as the founder of the Agricultural Experiment Station at Rothamsted, and as its presiding genius during a period of nearly sixty years.

We must go back again to 1842. When Sir John Lawes had taken out his patent, and had determined to start a factory in London, it would have seemed natural if his entire energies had been transferred to this new and promising sphere of labour; but now the truly scientific character of the man was made manifest. The agricultural investigations in the fields at Rothamsted, which had become so fascinating, were not to be given up, but extended. This could only be done by engaging scientific assistance. A young chemist, Dr. J. H. Gilbert, was engaged to superintend the Rothamsted experiments; and thus, in 1843, began that partnership in labour which has yielded such a rich harvest of results.

The station thus founded at Rothamsted began its work long before any of the agricultural stations now existing in other countries, of which there are at present several hundreds. The investigations carried out have proceeded to a considerable extent on lines peculiar to the place, and have generally been of a very laborious character. The most striking characteristic of Rothamsted is its experimental fields, covering nearly forty acres. Here the various crops of a four-course rotation are grown, both separately and in their usual order of succession; the influence of different manures upon the quantity and composition of the crops is studied; the alterations in the composition of the soil brought about by different treatment are determined, and in some cases the composition of the drainage water from the different plots is ascertained. The Rothamsted investigations have also included many important and laborious experiments on farm animals.

It is quite impossible to attempt to enumerate the various investigations made at Rothamsted. The first formal report appeared in 1847. The collected reports now occupy nine volumes. We may, however, note some stages in the development of this great enterprise. By 1848 most of the experimental fields had commenced their work; by 1856 the whole of the present series was in operation. The chemical work required soon exceeded the capacity of the old barn first used, and in 1854-5 a handsome new laboratory was built and presented to Sir John Lawes as a testimonial from the agriculturists of England for his services to agriculture. Large additional buildings for preparing and storing samples have since been added. In 1889 Sir John Lawes transferred the whole of the laboratories and experimental fields to trustees, with an endowment of 100,000*l.*, so that the agricultural investigations might be permanently continued. The management is now vested in a committee, nominated by the Royal, the Royal Agricultural, the Chemical and the Linnean Societies. The jubilee of the Rothamsted Station was celebrated in 1893, and on this occasion Dr. J. H. Gilbert received the honour of knighthood. A full account of the celebration will be found in *NATURE* of July 27 and August 3, 1893.

But we must turn once more to the man himself. Sir John Lawes received many honours. The Queen created him a baronet in 1882. Universities gave him their degrees; societies bestowed upon him their medals. Prosperity could not spoil him. Quite free from personal ambition, he was always ready to give the credit of success to his fellow-workers. Visitors to the Rothamsted experiments—and they were many—were delighted when Sir John himself was the pilot of the party; the two hours' talk to which they listened was a treat to be remembered. In terse, vigorous sentences the practical results of each trial were brought before them, while the whole was illuminated by many a flash of humour. In

his middle life Sir John Lawes wrote a great number of short articles for the agricultural press. In these he excelled. His thorough knowledge of the details of farming, and his practical mind, prevented him from ever writing as a mere doctrinaire; the facts ascertained by investigation were presented by him in their concrete aspect as things to be reckoned with by the farmer in his daily life on the farm.

Our notice would be incomplete without some reference to his local beneficence. As Lord of the Manor he did much to maintain and increase the charms of a pretty village now rapidly transforming itself into a town. He was the agricultural labourers' best friend. He provided them with an ample supply of allotment gardens, and in 1857 built a club room for their benefit; this was visited and described by Charles Dickens in 1859. Sir John Lawes also tried to introduce several co-operative schemes for the labourers' benefit. He was always seen to great advantage on the occasion of the annual allotment club dinner at which he presided, when he carved a huge piece of beef provided by himself, and afterwards made a humorous speech to the labourers. As a generous donor to public and private charities he will be long remembered.

As he passed into old age his powers seemed to suffer little diminution. A few days before his last illness he went as usual to London, and thence down to the factory at Millwall. He died on August 31, in his eighty-sixth year, full of days and full of honours, and venerated by all who knew him.

R. WARINGTON.

#### THE BRADFORD MEETING OF THE BRITISH ASSOCIATION.

IN the midst of the turmoil of the Association week it is difficult to give any careful compression of the results of the meeting; but, from the point of view of the Local Committee, the visit has been an unqualified success. Apprehensions were felt, in making the preliminary arrangements, lest there might be some incongruity in certain cases between the guests and the hosts: but, judging from the absence of rumours to that effect, the fears were groundless.

One point upon which at first some individual soreness arose was due to a slight misunderstanding in the matter of the excursions. These had long presented an exceedingly difficult problem to the local organisers of Association meetings; so much so, that the entire abandonment of all excursions has at times been contemplated. It is probably inevitable that, in any scheme put forward to ensure the success of the excursionists as a whole, some individual hardship must be occasioned, leading to a certain amount of unpleasantness. In the circumstances, it is scarcely surprising that, at first, a few sufferers should have complained that the excursion arrangements had been planned in a new and inferior manner; but, eventually, they fell in readily with the innovations. At former meetings it has been found impossible to organise excursions upon any exact system, owing to the fact that persons applied for tickets in a vague and undecided spirit, and often failed to take them up when they were allotted to them, to the consequent deprivation of other persons. Accordingly, in the Bradford scheme, the following regulations were issued:—

(1) That out of the seven excursions for the day three should be selected in the order of preference. (2) That the fee (made practically uniform) should be handed in with the application form; and (3) that persons complying with these requirements should in due course receive a ticket for one of the trips selected, or have their money returned. Those applicants who stated that they would only name a single excursion were